

FLOOD

Floods can be among the most frequent and costly natural disaster in terms of human hardship and economic loss, and can be caused by a number of different weather events. Certain health hazards are also common to these events. Standing water and wet materials in structures can become a breeding ground for microorganisms such as bacteria, mold, and viruses. This can cause disease, trigger allergic reactions, and damage materials long after the flood. When floodwaters contain sewage or decaying animal carcasses, infectious disease is of concern. Direct impacts such as drowning can be limited with adequate warning and public education about what to do during floods. Where flooding is in populated areas, warning and evacuation will be paramount to reduce life and safety impacts with any type of flooding. Placer County is susceptible to various types of flood events as described below.

Riverine flooding is defined as when a watercourse exceeds its “bank-full” capacity and is usually the most common type of flood event. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include many independent river basins. The duration of riverine floods may vary from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. The warning time associated with slow rise floods will assist in life and property protection.

The term “flash flood” describes localized floods of great volume and short duration. In contrast to riverine flooding, this type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour. Once flooding begins, personnel will be needed to assist in rescuing persons trapped by flood waters, securing utilities, cordoning off flooded areas, and controlling traffic. This could overtax local response capabilities and require outside mutual aid.

Urban flood events have resulted as land is converted from fields or woodlands to roads and parking lots and loses its ability to absorb rainfall. Urbanization increases runoff 2- 6 times over what would occur on natural terrain. During periods of urban flooding, streets can become swift moving rivers, while basements can become death traps as they fill with water.

Other types of floods include general rain floods, thunderstorm floods, snowmelt and rain on snow floods, dam failure floods, and local drainage floods.

The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program (NFIP). The potential for flooding can change and increase through

various land use changes and changes to land surface, resulting in a change to the floodplain. A change in environment can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Major Sources of Flooding

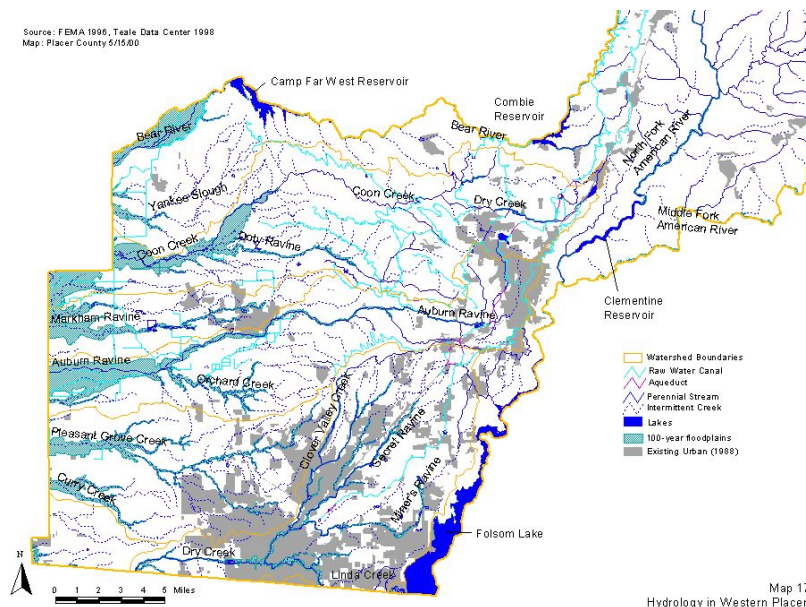
Placer County encompasses multiple rivers, streams, creeks, and associated watersheds. The County is situated in a region that dramatically drops in elevation from the eastern portion (Sierra Nevada) to the western portion, where excess rain on snow can contribute to downstream flooding. Damaging floods in Placer County occur primarily in the developed areas of the county extending westward from Colfax to Sacramento and Sutter Counties. Flood flows generally follow defined stream channels, drainages, and watersheds. Placer County crosses nine watersheds. The watersheds of Placer County include a combined drainage area of approximately 1,515 square miles.

The Watershed System

Although Placer County crosses nine watersheds, there are four main watersheds or areas that are the primary source of flooding within the county. These include the following watersheds as further described in the following paragraphs:

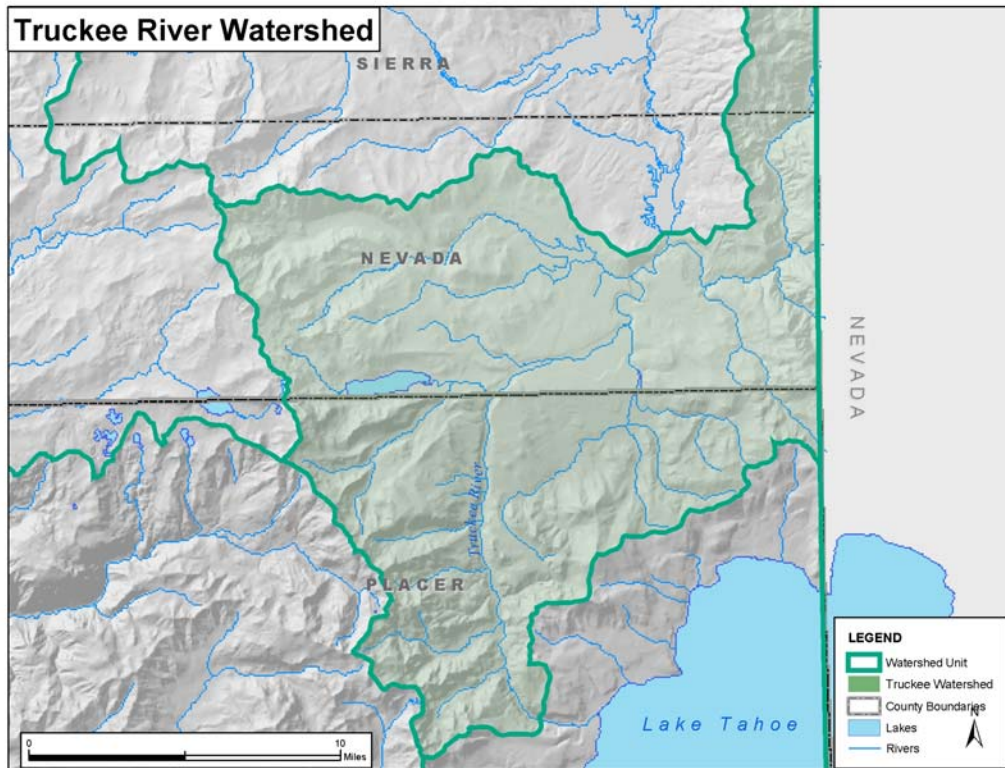
- Dry Creek Watershed
- Cross Canal Watershed
- Auburn/Bowman Area
- Truckee River Watershed

The following map illustrates the hydrology in Western Placer County.



(Source: Placer County Website)

A map of the Truckee River Watershed, located in Eastern Placer, is provided below.



(Map Compilation: AMEC Earth & Environmental; Source Data: CA-OES)

Dry Creek Watershed. Dry Creek watershed encompasses approximately 116 square miles in Placer and Sacramento Counties. In Placer County, the watershed is located in the southwestern portion of the county, and includes the City of Rocklin and Town of Loomis. The headwaters of Dry Creek are located in the upper portions of the Loomis Basin, in the vicinity of Penryn and Newcastle, in unincorporated Placer County, in the Granite Bay area near Folsom Lake, and in Orangevale in Sacramento County. The headwaters are located in the Sierra Nevada foothills at elevations of 900-1200 feet above msl. The mouth of Dry Creek, at its confluence with the Natomas East Main Drainage Canal, is at an elevation of about 30 feet above msl. Major tributaries to Dry Creek include: Antelope Creek, Clover Valley Creek, Secret Ravine, Miners Ravine, Strap Ravine Creek, Linda Creek, and Cirby Creek. Dry Creek drains to Steelhead Creek. Land use in the Dry Creek watershed varies widely, from agricultural, to residential, to commercial. The watershed is located in an area of rapid urbanization and population growth.

Incidences of flooding along Dry Creek and its tributaries are well documented. Floods in the Dry Creek watershed occur from October through April. The major flooding problems within this drainage basin occur where the north and south branches of Dry Creek converge. Flooding occurs when heavy rains and saturated soils cause streams to overflow their banks, flooding property and structures located adjacent to the streams. Streams also back up at culverts and bridges, blocking roads or making them unsafe. Continued development in both the upper and lower reaches of the watershed will likely make flooding problems worse.

According to the 1992 Dry Creek Watershed Flood Control Plan, substantial flood damages will continue to occur under existing conditions. Areas with the most extensive and frequent damages include areas along Miners Ravine in the vicinity of Joe Rodgers Road and upstream of Sierra College Boulevard; Paragon Court near Antelope Creek in Rocklin; areas along Cirby, Linda and Dry Creeks in Roseville; and along Dry Creek in Rio Linda. Some of these same areas are susceptible to flooding from storms as frequent as the 10-year storm. Many of the bridges and culverts in the watershed are inadequate to pass the 100-year event (70 percent). Nearly 50 percent of the stream crossings are inadequate for even the 25-year flood. Based on 1989 land use, structures that will be impacted by the 100-year flood are essentially those that were flooded by the February 1986 flood.

Floods generally caused by a combination of prolonged rainfall leading to saturated soils and a short period of intense precipitation occur from October through April. Dry Creek and its tributaries have an extensive record of historic flood, especially in the Roseville area. According to the 1992 report, damaging floods occurred in December 1955, April 1958, October 1962, December 1964, March 1983, and February 1986. The 1983, 1986 and 1995 floods were the largest and most damaging on record.

Cross Canal Watershed (Auburn Ravine/Coon Creek/Pleasant Grove Creek/Markham Ravine/Curry Creek). This watershed encompasses approximately 69,919.42 acres or 282.96 square kilometers, and includes 6 dams. Auburn Ravine, Markham Ravine, Coon Creek, Pleasant Grove Creek, Curry Creek and their tributaries drain approximately 292 square miles of northwestern and southeastern Sutter County (88 percent in Placer County and 12 percent in Sutter County) and are referred to as the Cross Canal Watershed. The Cross Canal, at the western portion of the watershed carries the combined flow of the creeks to the Sacramento River. The watershed slopes from east to west with elevations ranging from 2,500 feet to 25 feet. The eastern portion of the watershed is located in the foothills of the Sierra Nevada. Stream channels in this area have slopes of several hundred feet per mile. The eastern portion of the watershed is typified by the much flatter land of the Central Valley. Stream channels in this area have slopes of a few feet per mile. The City of Lincoln and portions of the Cities of Auburn, Rocklin, and Roseville are located within the watershed.

An extensive area upstream of the Cross Canal, in eastern Sutter County and western Placer County, is subject to periodic flooding. Major flooding in the watershed occurs as ponding and overland flow over many square miles of land east of the Cross Canal. Flooding also occurs adjacent to tributary streams where channel capacities are exceeded. Inadequately sized road crossings, land leveling, and channelization within the lower portion of the watershed have likely contributed to the frequency and degree of flooding. Future development in the watershed may also contribute to the flooding issue. The affected flooding area appears to be between 10,000 to 30,000 acres including the tributary streams. The Sutter-Placer Watershed Area Study by the Soil Conservation Service estimated approximately 31,000 acres of the watershed would be inundated during a 100-year frequency flood event. Approximately 95 percent of the potentially flooded area is west of Highway 65, in the flatter portion of the watershed. During major flooding, inundation along the individual streams combines upstream of the Cross Canal to form a continuous body of water approximately 10 miles by 3 miles. Several roads in the western

portion of the watershed flood once or more each year on the average (Placer County Water Agency 2001). Several elements contribute to major flooding in the watershed including limited channel capacity; undersized bridges and culverts; high river stages in the Sacramento River; and historical land leveling and channel modifications.

Auburn/Bowman Area. The Auburn/Bowman area is a largely rural area located in the Sierra foothills in Placer County. The area covers approximately 41.5 square miles and is contained in portions of six different drainage basins (or Watersheds): Bear River – 2.1 square miles, Orr Creek – 9.3 square miles, Dry Creek – 15.5 square miles (including Rock Creek – 4.3 square miles), Auburn Ravine – 10.8 square miles (including North Ravine – 4.6 square miles), Mormon Ravine – 1.4 square miles, Dutch Ravine – 1.0 square miles, the American River (North Fork) – 9.8 square miles, and Deadman’s Canyon – 1.0 square miles. This area is characterized by relatively steep slopes and moderate relief. Elevations in the area range from approximately 800 feet above msl in the southern portion of the study area to over 2000 feet above msl in upper Dry Creek and Orr Creek watersheds. Overall, most of the Auburn/Bowman area has elevations ranging from 1000 to 1500 feet above msl.

Flooding occurs when heavy rains cause streams to overflow their banks, flooding property and structures located adjacent to the stream. Streams also back up at culverts and bridges, blocking roads or otherwise making them unsafe. Emergency services can also be restricted by the flooded roads. In addition, there are numerous open canals in the study area which can intercept sheet runoff from one area and spill it into another. Excessive spills from these canals may also increase the potential for downstream flooding. According to the 1992, Auburn/Bowman Community Plan Hydrology Study, approximately 70 percent of the bridges and culverts in the watershed are inadequate to pass the 100-year flows for both existing and future conditions, and flooding will occur with the 100-year flood under existing conditions along Dry Creek Road. Specifically, flooding of up to 2 to 3 feet has been known to occur on Dry Creek Road between Dry Creek Road Bridge and Twin Pines Trail Bridge during a major storm event (e.g., March 1986). The flood of 1986 caused the most severe flooding damage to date in the Auburn/Bowman area. In addition to the overtopping of bridges and culverts, at several locations, flooding of structures occurred in the floodplains. Over 60 percent of the stream crossings are inadequate for even the 25-year flood.

Truckee River Watershed. The Truckee River watershed, with an area of approximately 2,720 square miles, encompasses the entire Lake Tahoe, Truckee River, and Pyramid Lake systems. The major tributaries to the Truckee River in California include: Bear Creek, Squaw Creek, Cabin Creek, Pole Creek, Donner Creek, Trout Creek, Prosser Creek, the Little Truckee River, Gray Creek, and Bronco Creek. Roughly, the middle third of the Truckee River watershed is located within Placer County, in Eastern Sierra Nevada, north of Lake Tahoe. A significant portion of the watershed is above 6,000 ft.

The overflowing and diversion of Squaw Creek (upper Truckee River Basin), is responsible for major flooding events, such as the January floods of 1997, in eastern Placer County. In the more urbanized areas, flood problems are intensified by the increased volume of water that must be carried away by streams. The volume is increased because rooftops of new homes and other

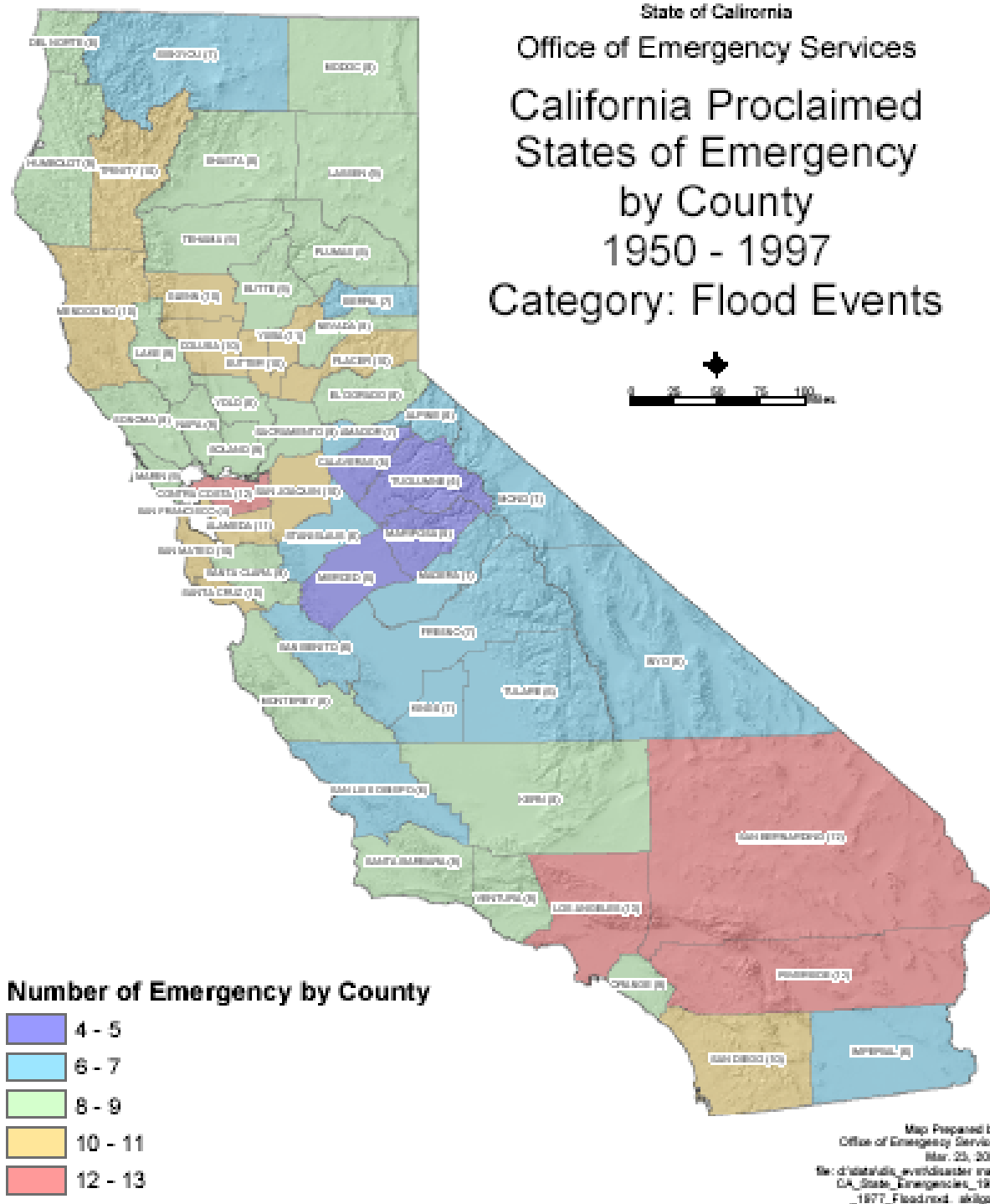
structures, as well as new streets, driveways, parking lots, and other paved areas all decrease the amount of open land available to absorb rainfall and runoff.

Past Occurrences

Historically, portions of Placer County have always been at risk to flooding because of its high annual percentage of rainfall, and the number of watercourses that traverse the County. Flooding events have caused severe damage in the very eastern and very western portions of the County, but are less of a threat within the center of the County. This is likely due to where the population is concentrated within Placer County; the majority live within the incorporated cities in western Placer County and in the Lake Tahoe region in eastern Placer County. According to the Draft California Multi-Hazard Mitigation Plan, Placer County has experienced 10-11 proclaimed states of emergency for flood events between 1950 and 1997 as evidenced in the map on the following page. The state plan indicates that Placer County has an estimated 1,471 Individual Assistance (IA) properties (with 267 of these falling within the 100-year floodplain) and 562 Public Assistance (PA) applicants associated with historic floods. Between, 1955 and 2002, the state plan further indicates that Placer County has experienced nine federally declared storm or flood disasters.



State of California
Office of Emergency Services
California Proclaimed
States of Emergency
by County
1950 - 1997
Category: Flood Events



(Source: Draft California Multi-Hazard Mitigation Plan)

The HMPC provided additional information on the following historical flood events in the County.

1852- This was the first big flood to be noted in Western Placer. Mining camps were just beginning to spring up in the Lincoln area, so hardly any structures were built which could be affected.

1860- Rains began during the first week of October and culminated in a big storm March 23-28. Major damage was reported from farms and mines along Coon Creek, Auburn Ravine, and Bear River. Main roads remained impassable for weeks.

1861-62- Lincoln had just been founded as a railroad and stagecoach center. The Lincoln-Folsom railroad was closed. The Auburn Ravine Turnpike was severely damaged and closed. Mining debris caused Bear River to change its channel to the south of its original course.

1875- Floods occurred along Bear River and destroyed the bridge to Grass Valley from Sheridan.

1880- Levees were finally being constructed along Bear River.

1955- Listed on NOAA's website as one of the "top 15 weather/water/climate events", significant and extended heavy rain and wind resulted in flooding throughout coastal and inland regions of northern California. Extensive flooding from small streams overflowing occurred in Placer County suburbs. Calculated damages for all areas affected within the State were 28 fatalities and \$1.8 billion in losses.

March 1983 – The March 1983 flood damaged approximately 25 residences along Linda and Cirby Creeks in Roseville. Portions of Royer Park were under water as well as areas in the Sierra Lakes Mobile Home Park. Dry Creek overflowed the Darling Way and Riverside Avenue bridges, disrupting traffic and flooding six businesses along Riverside Avenue.

February 1986 – This flood was classified as an approximate 70-year event.

Placer County was designated a Federal Disaster Area. The flooding caused widespread damage in most of the Dry Creek watershed. Flooding was significant in the Roseville, Rocklin and Loomis areas. Nearly all bridges and culverts were overtopped, with 30 sustaining embankment damage and the crossing at Rocky Ridge Drive washed out. Two bridges over Dry Creek were damaged and street cave-ins occurred at a number of locations. Total damages within Placer County are estimated at 7.5 million; damage estimates specific to the Dry Creek Watershed are not available. One person was killed and 62 homes damaged or destroyed within the watershed based upon applications for disaster assistance. Other sources report around 100 homes flooded with water levels up to five feet above floor levels. "Dozens" of businesses in downtown Roseville were damaged or destroyed. According to information on file with Placer County, as part of the disaster declaration, FEMA reimbursed the county \$376,611; no monies were reimbursed through the State.

1992 – Several days of continuous rain followed by a downpour caused Miners Ravine to overflow its banks and caused flooding that resulted in several dramatic rescues of people trapped in homes and vehicles.

January 1995 – This flood was classified as an approximate 100-year event. Placer County was designated a Federal Disaster Area. President Clinton toured the Tina/Elisa Way area of Roseville. The total damages within Placer County were estimated at 8.3 million with 750 damaged or destroyed structures. 4.2 million in damages were estimated for the Roseville area alone. Of the 4.2 million dollars in damages, one million was for road and bridge repairs and two million was for utility repairs. Within the Roseville area of Placer County, 385 homes, businesses, apartments, and mobile homes were damaged or destroyed; 2 Sewage treatment plants were overtopped; and 1 landfill was damaged. Impassable roads caused the closure of most schools. According to information on file with Placer County, as part of the disaster declaration, FEMA reimbursed the county \$882,158 and \$166,735 was reimbursed through the State.

As a result of the 1995 floods, in the San Juan water district, a creek crossing (bridge- where Carolinda Drive crosses the Miners Ravine Creek) washed out in two separate incidences (January 9th and February or March). The first wash out exposed main 10-inch ACP pipeline and made it vulnerable to high water and swift current. The crossing was rebuilt by the Carolinda Homeowner's Association, and the line went back into service. The second wash out occurred in February or early March, again due to high water and swift currents. This time the pipe was removed and a new bridge was built with the pipeline now being supported by the new bridge. The cost of repairs and replacement was \$30,400, of which \$27,000 was received through disaster funds.

1996 – Heavy rain and clogged storm drains, caused water to flow into the Cavitt School Gymnasium (Eureka Union School District) in South Placer County. A wood floor was lost. The \$85,976 in damages was covered by Emergency Services under a disaster declaration. The drainage system has since been modified.

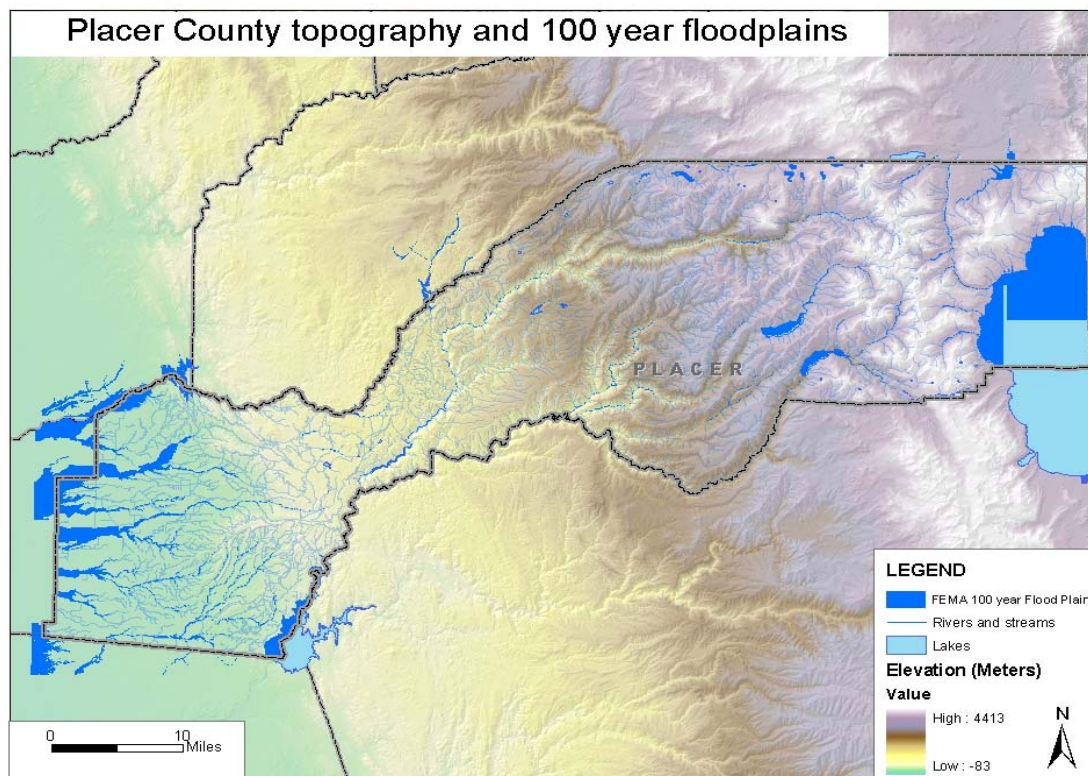
January 1997- A significant amount of rainfall and snowmelt runoff poured out of the Sierra Nevadas from December 30, 1996 to January, 1997. This was a very warm system and rain was falling at the 9,000 foot elevation. An estimated 25 inches of rain and snowmelt runoff occurred during this period on the Squaw Creek Basin (the upper Truckee River Basin in Placer County). This scenario was typical throughout the region and resulted in extensive flooding on the Truckee, Carson, Walker, and Susan Rivers. Consequently, record flooding occurred on much of the Truckee, Carson, and Walker Basins. In Placer County, flooding eroded away mountainsides, breaking sewer, water, and power lines. The south fork of Squaw Creek jumped its bank and burst through the lodge at the Squaw Valley Ski Resort. All bridges across Highway 89 were destroyed or severely damaged. Avalanches closed highway 89 in both directions isolating Squaw Valley from the outside world. Log jams caused the creek to diverge and deposit 3,500 cubic yards of gravel, boulders, logs and debris into the stream channel, piling the material up to six feet deep into homes and condominiums (USDA 1997). Mudslides blocked Squaw Valley Road and almost every other road in the area. In Placer County alone, damage estimates for public property was near \$11 million. 137 homes and 22 businesses were damaged

within the County. Total damage to private homes, businesses, agricultural losses, and private roads was near \$10 million. Destruction to the Federal Highway System was near \$7.7 million. According to information on file with Placer County, as part of the disaster declaration, FEMA reimbursed the county \$717,754 and \$177,451 was reimbursed through the State.

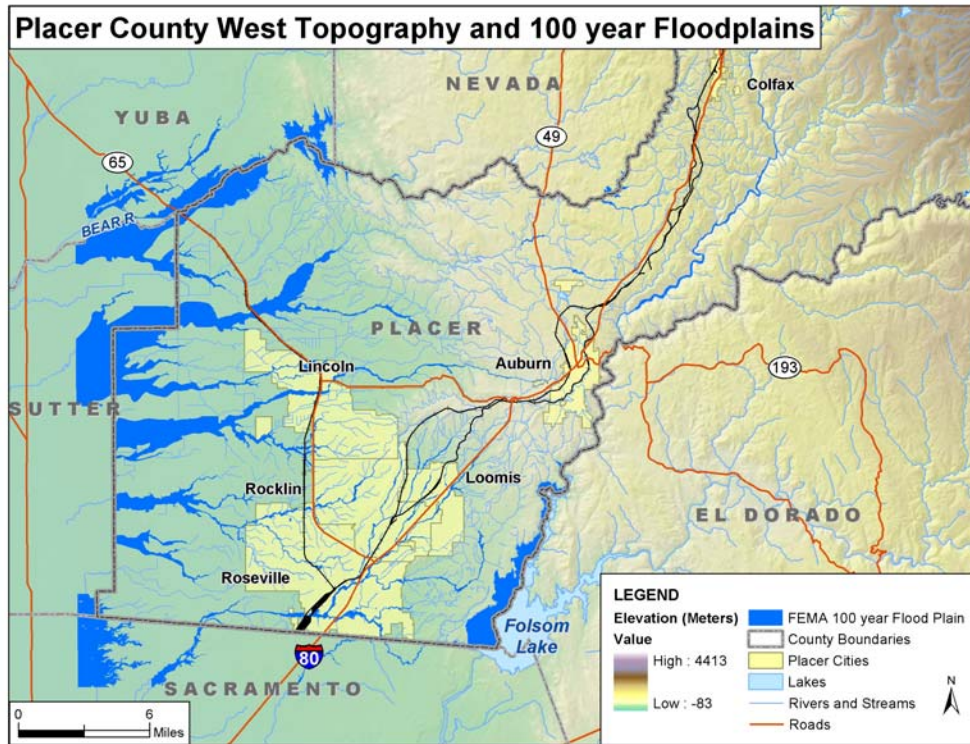
Auburn – Old Town section of Auburn flooded in 1986 and 1996 in an area not located in the mapped floodplain. Federal funding was received as a result of this event.

Likelihood of Future Occurrences

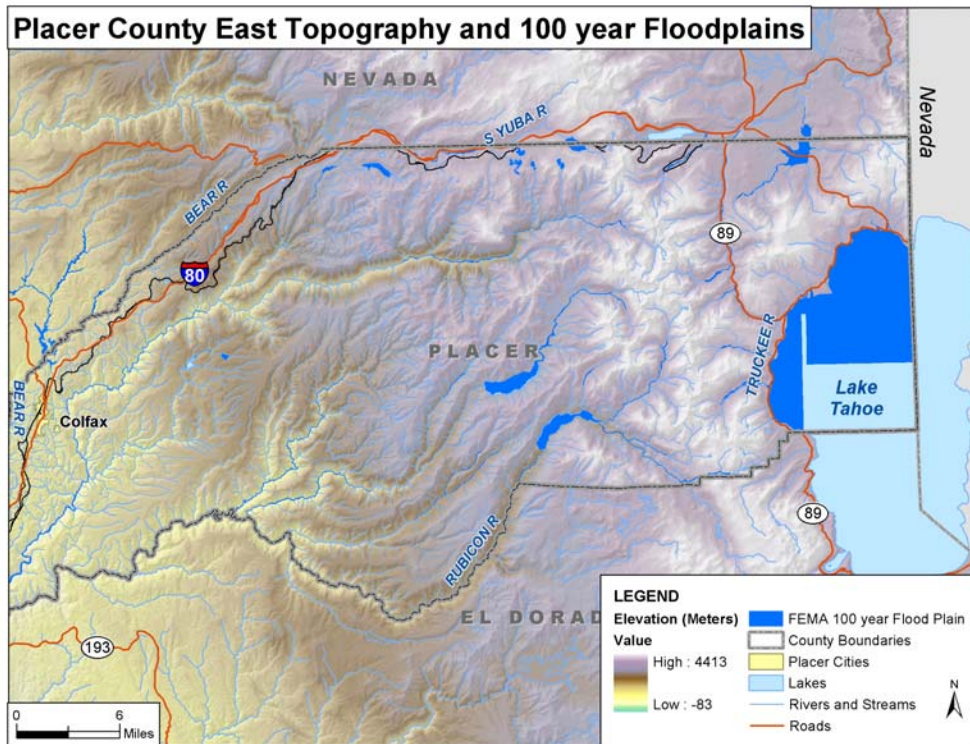
Western Placer County is more likely to experience flooding than the eastern part of the County. This is primarily due to being at a lower elevation and the recipient of runoff from multiple watersheds. With the exception of Colfax, portions of all other incorporated cities in western Placer are least partially located within the 100-year floodplain. However, flooding events have historically occurred in both western and eastern Placer. Existing watershed reports confirm that under existing conditions, flooding will continue to occur. The following figures illustrate the topography of the area and existing 100-year floodplains.



(Map Compilation: AMEC Earth & Environmental; Source data: CA-OES and FEMA Q3)



(Map Compilation: AMEC Earth & Environmental; Source data: CA-OES and FEMA Q3)



(Map Compilation: AMEC Earth & Environmental; Source data: CA-OES and FEMA Q3)

Various flood protection measures are either in place or planned to protect Placer County from future flood events. Existing flood protection measures include a comprehensive system of dams, levees, overflow weirs, pumping plants, channel improvements, floodway bypasses, detention and retention structures and other improvements. In addition, both the Placer County Flood Control and Water Conservation District and the City of Roseville maintain a system of ALERT Flood Warning gages, including 28 precipitation gages and 22 stream level gages located throughout the western Placer County that provide real time monitoring information on current flood conditions.

Based on input from the HMPC, in order to maintain or decrease the County's risk from floods, the County should continue to increase their level of flood protection, including carefully planned flood protection measures associated with new developments.

DAM FAILURE

Dams are man-made structures built for a variety of uses including, flood protection, power, agriculture, water supply, and recreation. When dams are constructed for flood protection, they usually are engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, then that structure will be overtopped. Overtopping is the primary cause of earthen dam failure. Failed dams can create floods that are catastrophic to life and property as a result of the tremendous energy of the released water. A catastrophic dam failure could easily overwhelm local response capabilities and require mass evacuations to save lives. Impacts to life safety will depend on the warning time available and the resources to notify and evacuate the public. Major loss of life could result and there would be associated health concerns as well as problems with the identification and burial of the deceased.

Dams typically are constructed of earth, rock, concrete, or mine tailings. Two factors that influence the potential severity of a full or partial dam failure include:

- The amount of water impounded, and
- The density, type, and value of development and infrastructure located downstream.

Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding,
- Earthquake,
- Inadequate spillway capacity, resulting in excess overtopping flows,
- Internal erosion caused by embankment or foundation leakage or piping,
- Improper design,
- Improper maintenance,
- Negligent operation, and/or

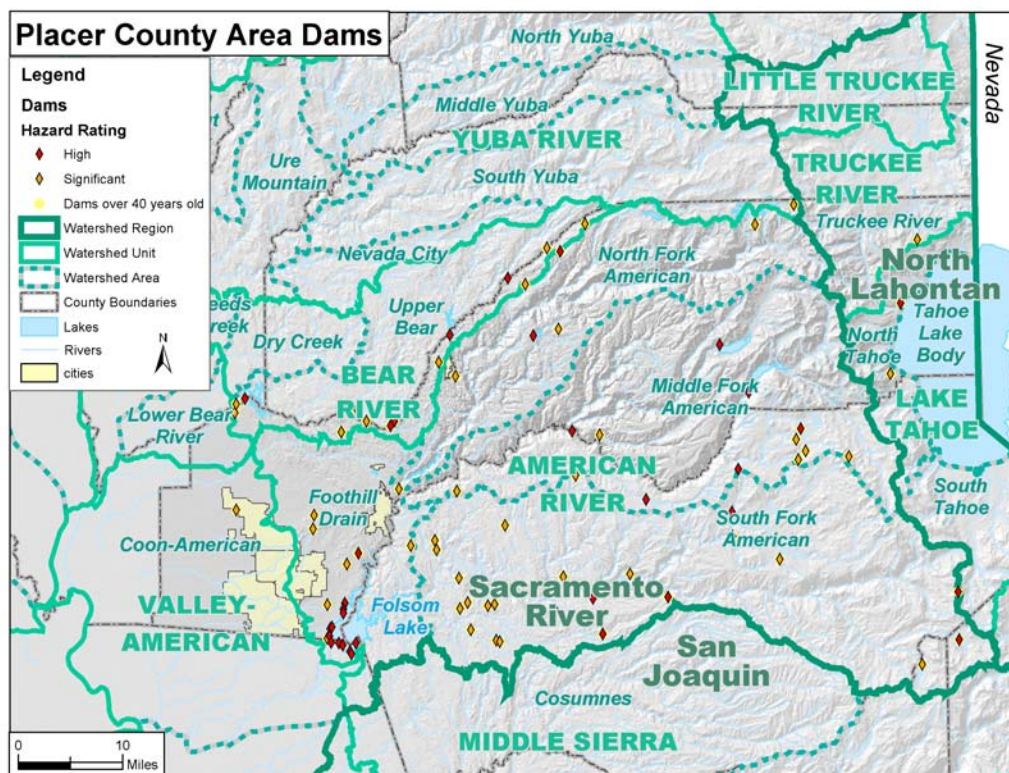
- Failure of upstream dams on the same waterway.

Dams and reservoirs have been built throughout California to supply water for agriculture and domestic use, to allow for flood control, as a source of hydroelectric power, and to serve as recreational facilities. The storage capacities of these reservoirs range from a few thousand acre-feet to five million acre-feet. The water from these reservoirs eventually makes its way to the Pacific Ocean by way of several river systems.

There are several major and minor dams, which, if they fail, may impact the people and resources of Placer County. According to the 1994 Placer County General Plan Background Report, eleven Dams in Placer County are at least 75 feet tall or have a capacity of 10,000 acre-feet of water. Thirty-three smaller dams are located throughout the county. Failure of any one of these dams would flood downstream areas and could cause loss of life and property.

Based on the National Inventory of Dams database provided with FEMA's HAZUS loss estimation software, there are ninety dams rated as "high" or "significant" hazard that could potentially impact Placer County if a failure was to occur. This includes dams that may lie in neighboring counties that drain into Placer County. Thirty-seven of the ninety dams are classified as high hazard. Fifty-three are rated as a significant hazard.

The following map identifies high hazard and significant dams in the Placer County area.



(Map Compilation: AMEC Earth & Environmental; Source data: HAZUS)

Past Occurrences

According to the HMPC, there have been three dam failures in the area:

Hell Hole Dam Failure - In 1964 construction of the Hell Hole dam was underway and the contractor had stopped operations for the winter. A major storm event (rains) occurred during December 1964 causing the Hell Hole Reservoir to fill and since the dam was not completed, it failed sending a considerable amount of water towards Auburn. The water washed out a bridge on Highway 49 over the American River at the confluence of the North and Middle Forks and flooded a quarry. Due to the way the construction contract was worded, the contractor had to rebuild the dam at his own expense. As a result, Placer County incurred no costs related to this event. No claims were filed against PCWA by either the quarry owner or the state for damages.

1986 Auburn Coffey Dam Failure – As a result of area flooding, the Coffey Dam at Auburn breached and partially washed away. The U.S. Bureau of Reclamation had designed the Coffey Dam for a controlled failure by building a soft earthen plug into the dam for this purpose. It appears the dam failed as designed.

August 2004 Ralston Dam Release Gate Break- A broken release gate on Ralston Dam in the middle fork of the American River prompted the National Weather Service to issue a flash flood warning until 1 p.m. in Placer County.

According to the PCWA, the gate near the Ralston Powerhouse malfunctioned at 6 a.m. The sudden release of water from Ralston Reservoir south of Auburn sent a "wall of water three- to four-feet high" down the river. About 800 to 1,000 acre-feet of water were released, with flows peaking between 10-11 a.m. It was expected to reach Folsom Dam by 12 noon. Sheriff's deputies and California Highway officers alerted campers in the Auburn State Recreation Area to move to higher ground. The CHP was monitoring the muddy water as it approached Highway 49. There were no immediate reports of injuries or damage along the river, which is popular with rafters, kayakers and residents fleeing the summer heat.

Likelihood of Future Occurrences

The County is potentially at risk from numerous dams under a variety of ownership and control and of varying ages and conditions. As a result, although infrequent, the potential exists for future dam failures in the Placer County planning area.

LANDSLIDE

Landslides refer to a wide variety of processes that result in the perceptible downward and outward movement of soil, rock, and vegetation under gravitational influence. Although landslides are primarily associated with steep slopes, they may also occur in areas of generally low relief and occur as cut-and-fill failures; river bluff failures, lateral spreading landslides;

collapse of wine-waste piles; failures associated with quarries and open-pit mines. Landslides may be triggered by both natural and human-induced changes in the environment resulting in slope instability.

Past Occurrences

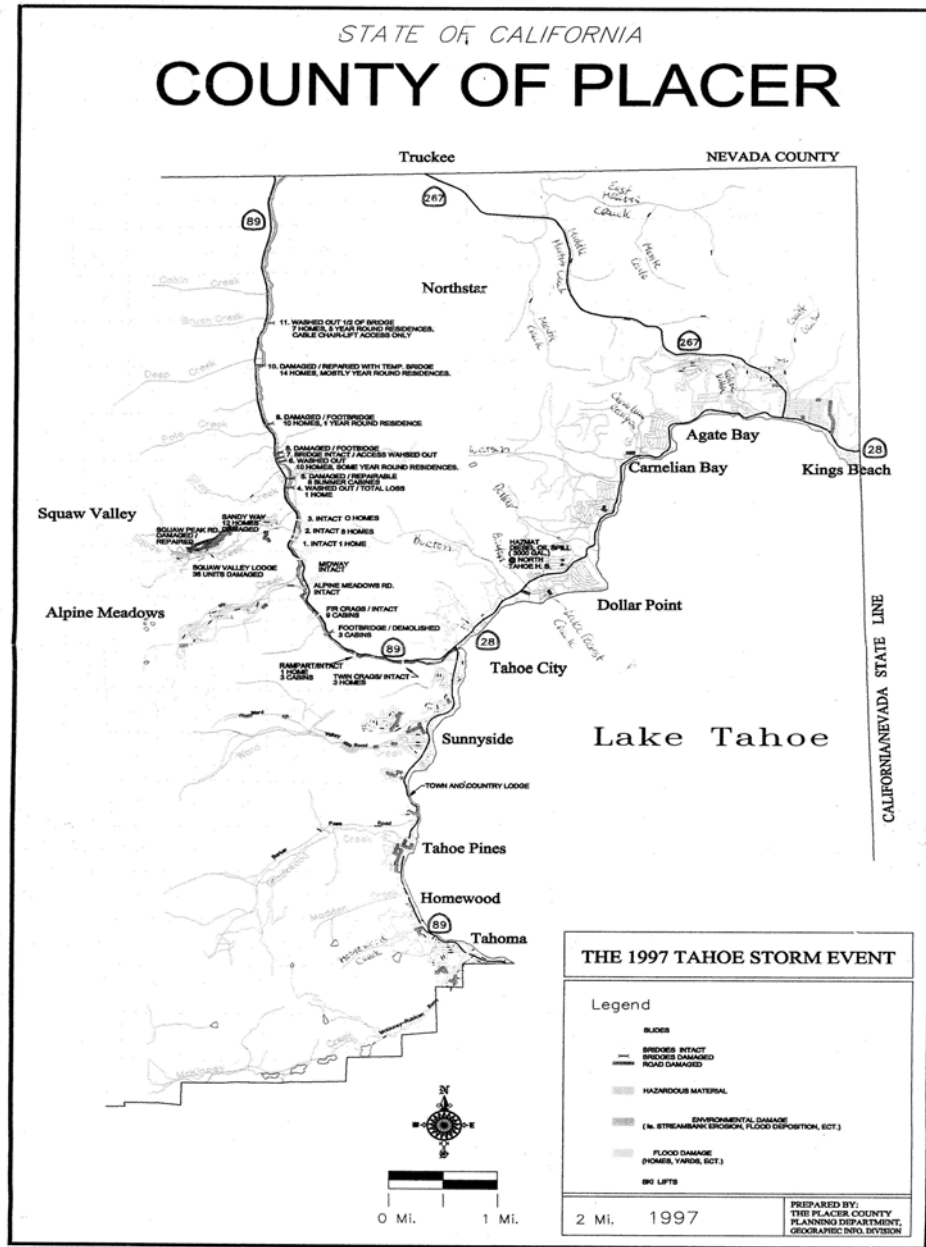
The Draft California Multi-Hazard Mitigation Plan indicates there have been no disaster declarations between 1950 and 1997 associated with landslides in Placer County. According to the Placer Operational Area OES, landslides may occur throughout Eastern Placer County. They tend to occur with the greatest frequency on steep slopes adjacent to transportation routes. Interstate 80 east of Colfax and State Route 49 south of Auburn are frequently affected areas. Information provided by the HMPC included documented landslides in the Tahoe area along Truckee River, Squaw Creek and Bear Creek, associated with the 1997 flood event. The three major landslides were identified as the Wayne Road Landslide, the Sandy Way Landslide, and the Navajo Court Landslide.

Wayne Road Landslide – The Wayne Road Landslide is the most significant of the three landslides. The Wayne Road Landslide is actually the result of two separate failures occurring in separate drainages. The drainages meet just upslope of the impacted area directly west of the intersection of Sandy Way and Wayne Road. Based on information provided by local residents and Placer County personnel, the homes in the area were also impacted by landsliding in 1982 and in 1986. The 1982 event was larger than the 1986 event. Placer County personnel stated that, following the 1986 landslide, several small sedimentation basins were constructed north of Sandy Way in an attempt to contain future slide debris. These sedimentation basins were obliterated by slide debris during the 1997 event. Slide debris consisted of saturated, loose, silty sand and sandy silt with rock ranging in size from gravel to boulders up to 4 feet in diameter. The debris plugged existing culverts and several feet of slide debris was deposited against the sides of several residents.

Sandy Way Landslide – The Sandy Way Landslide occurred approximately one-quarter mile west of the Wayne Road Landslide, originating just west of Squaw Summit Road and deposited significant debris upslope of several residences on Sandy Way.

Navajo Court Landslide – The Navajo Court Landslide originated just east of a 300,000-gallon water storage tank located above the intersection of Navajo Court and Squaw Summit Road. The landslide debris flowed downslope, inundating the intersection of Navajo Court and Squaw Summit Road and plugged two culverts beneath Squaw Summit Road. The channel was rerouted to the west and flowed down both sides of Navajo Court, eroding new gullies on both sides of the road. Debris continued downslope, plugged two culverts beneath Christy Lane and deposited a significant amount of debris in the parking lot behind the post office on Squaw Valley Road.

A map depicting the landslide areas is provided on the following page.



(Source: Placer County Planning Department)

Likelihood of Future Occurrences

Based on observations made by the Placer County Department of Public Works following the 1997 slides, the landslides were classified as debris flows that generally occur in the immediate vicinity of existing drainage swales or steep ravines. Debris flows occur when near surface soil in or near steeply sloping drainage swales becomes saturated during unusually heavy precipitation and begins to flow downslope at a rapid rate. Debris flows can reach speeds of up to 10 feet per second. The source areas of all three debris flows described above were in areas of existing springs. Landsliding has likely occurred numerous times in the past, probably over the

last several hundred, if not thousands of years as evidenced by past deposits exposed in erosion gullies. Although the immediate risk of additional sliding was reduced with colder temperatures, with significant rainfall, additional failures are likely. In addition, volumes of unstable debris remaining in areas of moderate slopes create a high probability of future landsliding in the area. The Placer County Department of Public Works further concluded that landslides will continue to impact the area when heavy precipitation occurs, as they have in the past, and prevention of such events is virtually impossible.

AVALANCHE

Avalanches following significant snowstorms have resulted in fatalities within the County. The vast majority of avalanches occur during and shortly after storms. Avalanches occur when loading of new snow increases stress at a rate faster than strength develops, and the slope fails. Critical stresses develop more quickly on steeper slopes and where deposition of wind-transported snow is common. Historically, they have occurred between the months of January and March, following snowstorms. This hazard generally affects a small number of people, such as snowboarders, skiers, and hikers who venture into backcountry areas during or after winter storms. Roads and highway closures, damaged structures, and destruction of forests are also a direct result of avalanches. The combination of steep slopes, abundant snow, weather, snowpack, and an impetus to cause movement create an avalanching episode. Avalanche hazards exist in eastern Placer County, where combinations of the above criteria occur.

Past Occurrences

Areas where the potential for avalanches to exist are zoned as moderate or high avalanche hazard zones and have been identified using maps available at the Placer County Planning Department. Moderate hazard zones are usually on shallow slopes and located immediately downhill of high zones. These high and moderate zones are located near the Nevada County line, south of Donner Lake and Lake Van Norden, east of Tahoe City, near Twin Peaks and McKinney Bay, and in areas near Squaw Valley, Alpine Meadows, and Sugar Bowl. According to the 2004 Placer Operational Area, Emergency Operations Plan, areas of particular concern include:

- Alpine Meadows, Bear Creek
- Donner Lake (West Shore), Donner Summit, Norden Area
- Lake Tahoe (West Shore), Homewood Area
- Serene Lakes, Onion Creek
- Squaw Valley Area
- Sugar Bowl, Onion Creek
- Truckee River Corridor
- Ward Creek Tract

The following recent avalanche incidents have resulted in fatalities within Placer County:

March 31, 1982 – At Alpine Meadows a 30-foot high wall of snow plowed through a ski lodge and other buildings at 80 mph, killing seven people.

February 11, 1998 – Donner Summit backcountry, one fatality - snowboarder.

February 6, 1999 – Donner Summit, one fatality.

February 21, 2001 – Squaw Valley, two fatalities, Class II Avalanche. A storm resulted in 20 inches of snow and winds out of the SSW were at 40-50 miles per hour range with gust up to 60-70 miles per hour.

March 8, 2002 – Sugarbowl Resort, one fatality. A storm hit with 34 inches of snow and winds were up to 100 miles per hour.

January 1, 2004 – Donner Summit near Castle Peak, one fatality.

Likelihood of Future Occurrences

Given the topography and amount of snow falling on an annual basis in Eastern Placer County, avalanches will continue to occur. The loss of life due to an avalanche is usually due to people recreating in remote areas at the wrong time. Avalanche warnings are posted after winter storms; therefore, information is available to reduce the risk of being caught in one. Reoccurrences will most likely continue if people continue to take risks in backcountry areas during the winter months.